be accomplished commonly with a 3×3 matrix represented as M[x,y]. This M[x, y] matrix relates to the color primaries and color volume that a particular R, G, and B color space is desired to encompass. Alternatively, just an 1×3 matrix, that corresponds to one of the rows of M[x, y], e.g. the first row, may be used to convert a first component (commonly the Y), followed by a subsequent step to generate all other components given the previous conversions. For example, in the non-constant luminance representation of Y'CbCr as is specified in standard specifications such as ITU-R BT.709 and ITU-R BT.2020 among others, Y' may be calculated as M[1,1]*R'+M[1,2]*G'+M[1,3]*B' where R', G', and B' are the non-constant luminance transformations of the captured RGB image data and M[1,1], M[1,2], M[1,3] appropriate transform coefficients that may relate the conversion of R, G, and B data back to a luminance (Y) signal in the XYZ color space (also known as the International Commission on Illumination or CIE 1976 color space). It should be noted that the R, G, and B data in the non-constant luminance method may have already been converted using an appropriate transfer function method, e.g. power law gamma, ST.2084/PQ or some other transfer function, into non-linear data before this conversion.

[0031] Then the Cb and Cr components of the image data may be calculated using either the Y' signal and some of the other transformed components, commonly B' for Cb and R' for Cr, or using only the R', G', and B' values and appropriately defined matrix M coefficient values. In the constant luminance domain, Y' is computed as Y'=(M[1,1]*R+M[1,2]*G+M[1,3]*B)'. The single quote here is an operator indicating application of the transfer function. In this scenario, the transfer function is only applied at the end of the transformation process from R, G, and B to Y, where now these color components are in the linear domain. In some embodiments we may call Y' of the non-constant luminance case as Y_ncl', and of the constant luminance as Y_cl' to differentiate between the two. In others, we may still use Y' for both and differentiate between the two if needed. Commonly, for the constant luminance conversion, only a 1×3 matrix is used to create the Y' component. The Cb and Cr components are then computed based on this value and the B and R quantities after the same transfer function is applied onto them, resulting in B' and R' values.

[0032] According to an embodiment, in the non-constant luminance domain, Cb may be calculated as Cb=(B'−Y')*Sb and Cr is calculated as Cr=(R'−Y')*Sr. Sb and Sr relate to the color primaries that a particular R, G, and B color space is desired to contain. In the constant luminance domain, commonly if B'−Y' is less than or equal to zero, Cb is calculated as Cb=(B'−Y')*Nb, otherwise Cb is calculated as Cb=(B'−Y')*Sb. Similarly, if R'−Y' is less than or equal to zero, Cr is calculated as Cr=(R'−Y')*Nr, otherwise Cr is calculated as Cr=(R'−Y')*Sr. In these equations, it is possible to set Nb=Sb and Nr=Sr, but these values are commonly selected given the characteristics of the color space and the transfer function involved in the conversion. In particular, for both cases, i.e. constant and non-constant luminance, it is intended that the Cb and Cr values are always within [−0.5, 0.5]. Given that, one can easily compute the minimum and maximum value that may result for Cb and Cr respectively and determine those quantities. For example, for the non-constant luminance case we would have the following computation for Cb:

$$B'-Y'=-M[1,1]*R'-M[1,2]*G'+(1-M[1,3])*B'$$

[0033] The maximum value for this derivation is (1−M[1,3]), and the minimum value is −(M[1,1]+M[1,2]). Therefore the range, before normalization is [−(1−M[1,3]):(1−M[1,3])]. Given this, we can compute that Sb=1/(1−M[1,3])/2. A similar derivation can be applied for the Cr component and Sr.

[0034] Similarly, for constant luminance we will have:

$$B'-Y'=B'-(M[1,1]*R+M[1,2]*G+M[1,3]*B)'$$

[0035] In this case, the maximum value would be 1−(M[1,3])' and the minimum value would be −(1−M[1,3])'. The range is asymmetric, and transfer function dependent. Given these values one can derive the Nb and Sb quantities, and similarly can also compute the Nr and Sr quantities for Cr.

[0036] In an embodiment, and for the constant luminance case, the Cb/Cr components may be alternatively calculated according to the following:

$$Cb\_temp=(B-Y)*Sb$$

$$Cr\_temp=(R-Y)*Sr$$

[0037] where Y here is in the linear space, and also corresponds to the actual luminance information of the signal. Sb and Sr are quantities that try to preserve the color information as much as possible, given a subsequent quantization process. Then:

$$Cb=\text{sign}(Cb\_temp)*TFcb(\text{abs}(Cb\_temp))$$

$$Cr=\text{sign}(Cr\_temp)*TFcr(\text{abs}(Cr\_temp))$$

[0038] Where the TFcb/ITFcb and TFcr/ITFcr correspond to a particular transfer function and its inverse applied to each color component. Note that this transfer function does not need to be the same as the transfer function applied for generating the Y' component. The TF could be more subjectively "tuned" for color information, or the same TF that is applied on Y may be applied.

[0039] Similar considerations for deriving Sb and Sr need to be applied as discussed previously, i.e. we need to ensure that the Cb and Cr quantities remain within the [−0.5, 0.5] range after conversion.

[0040] In an embodiment, and for the non-constant luminance case, the Cb/Cr components may be calculated according to the following:

[0041] First calculate the Y component as Y'=M[1,1]*R'+M[1,2]*G'+M[1,3]*B'. Y' is then converted to an inverted transform form Y_ncl, Y_ncl=ITF(Y'). It should be noted that commonly, i.e. unless the TF was a linear TF, Y_ncl !=Y. Then:

$$Cb\_temp=(B-ITF(Y'))*Sb$$

$$Cr\_temp=(R-ITF(Y'))*Sr$$

And as above,

$$Cb=\text{sign}(Cb\_temp)*TFcb(\text{abs}(Cb\_temp))$$

$$Cr=\text{sign}(Cr\_temp)*TFcr(\text{abs}(Cr\_temp))$$

[0042] With TFcb and TFcr being appropriate transfer functions.

[0043] Similar considerations for deriving Sb and Sr need to be applied as previously discussed, i.e. the Cb and Cr quantities should remain within the [−0.5, 0.5] range.